The Program

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Il faut qu'il n'exige pas le secret, et qu'il puisse sans inconvénient tomber entre les mains de l'ennemi. —*Auguste Kerckhoffs, 1883*

The widow of Esteban Neri brought the Program to my office in a tin that had once contained throat lozenges. The tin also held a brass key. She put the key in her coat pocket and left me the Program.

Her husband had been found at the foot of a service staircase on the eighth of January. The building belonged to an association of documentary insurers; he had gone there to examine some certificates. His appointment was recorded. His departure was not. The

association had paid for the funeral with a promptness that had offended her more than a refusal would have done. She wanted to know whether the Program had paid for his death. I asked whether she had spoken to the police. She said that the police were looking for a man.

The drive in the tin held 87,412,096,512 bytes. This was the ordinary distribution, available from several thousand public mirrors, together with a recent envelope and a directory of Neri's working papers. I already had the Program. So did the police. There had been a period when possession of it was treated as evidence of participation in its affairs. The practice had been abandoned after it became apparent that the best-equipped police laboratories were, by that criterion, its principal offices. Its digest under the second of the standard hash functions begins with the characters 7e3c9a and continues for fifty-eight more, and those sixty-four characters are, in a sense I will try to make precise, its name, its passport, its face, and the only thing about it that anyone has ever been able to confirm.

I told her that nothing on the device would necessarily identify a payer. She said her husband had told her to bring it to me. He had written my name on the inside of the lid, in the cramped hand I remembered from our

years at the register. Under it were the words: *Do not accept the appointment.*

I had received the appointment that morning. It was a request to replace Neri as the third examiner in the discontinuance of a documentary trust. The fee was high but not exceptional. A person accustomed to seeing an exceptional fee every week ceases to distinguish it from his income.

I asked his widow when he had written the instruction. On the evening before his death, she said. He had not been particularly agitated. He had checked that she knew where the tin was kept and had complained about an invoice for the elevator. Neri's apartment was on the ground floor. I remembered this grievance too.

The trust was designated Register Seventeen. Its business was to certify the independence of other certifiers. Nobody had found a more economical way of determining whether two reputable institutions were secretly the same institution than to establish a third reputable institution and ask it. Seventeen had prospered until the resignation of two of its trustees. A purchaser now proposed to retire it, assume certain liabilities, and take possession of its documentary reserves. The purchaser's identity was concealed by an arrangement that was valid under the trust's own rules. Before the trans-

fer, three examiners had to certify that the proposed successor satisfied its independence requirements. Neri had been the third.

My professional qualification was an acquaintance with failures of this kind. For twenty-six years I had compared statements that were each correct according to their own definitions. I was good at noticing when the definitions changed. This is a less elevated occupation than detecting falsehood, and it pays rather better.

The widow asked me again about the Program. I told her it was possible to establish that a particular instruction had come from it. It was harder to establish which instruction a man had been following. She looked at the tin, as if it were unreasonable for something so completely delivered into my possession to continue withholding this distinction.

Before leaving she gave me the brass key. She had forgotten that Neri had asked her to do that as well. It opened his apartment. I put it beside the device and undertook to make an inventory. I did not accept the appointment.

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Mara Varela arrived at four with a loaf of bread, which she put on the papers because there was nowhere else

to put it. She worked in the mathematics faculty and disliked discussing cryptography with anyone who believed it was a branch of secrecy. Most of her working life had been spent specifying what a stranger was permitted to learn.

She checked the distribution against the published digest. The file was genuine. Its age could also be established: that digest had been included in a transaction twenty-three years earlier, and the transaction had been buried under the subsequent accumulation of work. This established the existence of those bytes by a certain point in the ledger's history. It did not establish who had written them, or what the writer had intended, or the hour on a clock in Montevideo. The founder's admirers had derived all three conclusions from it.

The file had appeared on the ninth of November of that year, on a tracker in Minsk that had been used until then for films. The uploader's account was eleven minutes old. Beside it there was a second file of 1,204 bytes, in plain text, which has come to be called the Manual, and which describes, without a word of explanation, what the Program accepts and what it returns. It contains no verbs of intention. It does not say what the Program is for, and it does not say who wrote it, and in the years since, the people who have devoted their

lives to it have added to those two questions a third, which is whether it is for anything at all. A student in Bydgoszcz ran it first, on a borrowed machine, over a weekend, feeding it the headers of the chain up to that morning and nothing else, and after nineteen hours received an envelope of forty kilobytes and a single transaction, both of which he published, because the Manual, in its last line, says that outputs are to be published, and he had no reason to disobey a document that had asked nothing else of him. The transaction was valid. It entered the shielded pool in the next block. On the tenth of November something that no one could see moved from a place no one could name to a place no one could name, and the student, who did not sleep that night, had been the hand that moved it, and knew this, and knew nothing else.

The Program was often described as an encrypted program. There was no objection to the phrase in conversation, provided the conversation went no further. The file did not decrypt itself into an ordinary program when it was run. There was no interval during which an attentive owner of the machine could read the private instructions out of memory. What ran was the transformed computation itself. Anyone may load the file into a debugger and step through it one operation at

a time, an addition, a comparison, a lookup in a table, another addition, for as many operations as there are grains of sand in a considerable beach, and every operation is visible, and correct, and means nothing. The secret was not a letter inside a locked box. Opening the box was the advertised service.

Its construction belonged to the family known as indistinguishability obfuscation. In the last century it had been assumed, by everyone who thought about it, that a program could not be hidden from the person running it, because the machine must be told what to do and whoever holds the machine hears the telling. Then the wish was made precise, and something odd happened. The strong form of it, a program from which nothing whatever could be learned beyond what running it reveals, was proved impossible for programs in general, not hard but impossible, and the field mourned it briefly. What survived the mourning was a weaker promise, established on ordinary foundations in a paper by three authors in the year of the plague. Take two circuits of the same size computing exactly the same function. Obfuscate each. Efficient examination of the results was not to disclose which implementation had been supplied. That is all it says. It does not say that the program's secrets are hidden; it says only that two pro-

grams which keep the same secrets in different ways are the same program to every observer. And it was shown, not long after, that this apparently modest promise is the ceiling: whatever any obfuscator could ever hide, this one hides, so that the impossible strong form, wherever it is possible at all for a particular program, is delivered by the weak one for free. The technicians call it indistinguishability obfuscation, a name that tells you nothing unless you already know, which is the custom in that field, and which I have come to think is a kind of honesty.

Protection of the Program's spending authority required a separate argument for the particular construction. Its auditors had supplied one, with the customary assumptions about computational difficulty and the less customary insistence that none of them had inspected the private commercial policy. Mara gave me the argument in the form she used for people who asked why one could not simply stop the machine at the moment of signing and read the key out of the register. Imagine two clerks. The first carries a full ring of keys and is under orders never to open the thirteenth door. The second carries the same ring with the thirteenth key removed. On every errand you could ever send them, they behave identically; neither will ever open the

thirteenth door, one because he is forbidden and one because he cannot. Now suppose that mugging the first clerk reliably got you through the thirteenth door. Then mugging would be a way of telling the clerks apart, and the promise says there is no way of telling them apart, and so mugging does not work, even on the clerk who has the key. The second clerk is never hired. He exists only in the proof, as a thought, to show that the first clerk is safe. The argument has a limit, which she stated before I could ask: it covers only doors the clerk would never open. A door he would open under some instruction, however costly the instruction is to arrange, is not covered, and the mathematicians are careful to say so, and the world is careful not to hear them.

The distinction had not troubled its early investors. They had purchased a proof of confinement and had gradually begun speaking of a proof of good character.

None of this was unforeseen, and that is the part of the history hardest to explain to people who have come to the Program recently and imagine it arrived out of nothing. A boy of twenty described nearly this object, in a magazine for enthusiasts, more than thirty years before it was built: a program with a key inside it, published to the world, that anyone could run and no one could rob. Soon after, others had used the chain as a

clock, sealing messages that could be opened only after a certain quantity of work had been done by strangers. Before either, others had worried at the problem of a program that may be run once and never rewound. The Program is the assembly of ideas that had each been written down, separately, by people who did not expect to see them assembled, in the way that the parts of a cathedral are each older than the cathedral. Whoever built it read the same papers Mara did and did what the papers said. That is not nothing. It is also not the miracle it is taken for.

The signing and decryption keys had been generated in a distributed ceremony, in the manner the shielded pools themselves had been founded, in which strangers in different countries each made a fragment of a secret, combined the fragments without ever seeing one another's, and destroyed their machines afterward. The computation that assembled the final object used secret shares, and the recorded procedure required the participants to destroy their remaining shares. Under the stated honesty threshold, no participant had learned a complete key. The ceremony transcript could establish that certain calculations had been performed correctly. It could not establish what everyone had forgotten. The obituary of the supposed founder had treated his death

as the final security measure, although his knowledge of the complete keys had never been demonstrated.

The commercial logic was a separate uncertainty. Parts had been contributed privately by several parties. The public commitment fixed which hidden material had been compiled. It did not disclose that material. It was possible that somebody had known the whole charter. It was possible that nobody had. The Program had not published an opinion.

Size was the other favorite subject, because it was one of the few things about the Program that could be measured without cooperation. Any program can be padded, filled with instructions that do no work, to any size at all, and the obfuscation of the padded program is indistinguishable from the obfuscation of any other program of that size with the same behavior. Eighty-seven gigabytes was a ceiling on what it contained and not a floor. A machine that adds two numbers could be dressed in eighty-seven gigabytes, and so could a machine that has read every book. Padding accounted for part of it. The rest did not supply a census of hidden intentions. It was the one property of the Program that everybody could measure, and the one property that had been proved to carry no information, and I had

watched, for twenty years, the whole world measure it anyway.

By the early forties a succession of engineering improvements had made a narrow class of such objects tolerable to use. The Program remained a conspicuously expensive member of the class. On my workstation an ordinary transition took nineteen minutes. Large inputs required preliminary proofs and several transitions. There was no implication that arbitrary intelligence had been compressed into a convenient package. The file was an appliance with a costly and particular function. Mara connected the device to an isolated machine. She had once supervised a project to identify meaningful internal regions by timing its execution. The project had identified the time required to run it.

The public interface accepted an old state, evidence, and a proposal. The state was the envelope, encrypted and authenticated, of which more in a moment. Evidence was the headers of the chain, which anyone may download; signed records, the dispatches of the four wire services, which had for decades signed their output under published keys as a defense against forgery, and the daily digests of registries, courts, ports, and land offices, likewise signed; and documents addressed to the Program's public receiving key, which anyone

might write and only the Program could read. A proposal might be a bid for a contract, an application for a grant, or a request to perform an already authorized step. Rejection was usually indistinguishable from an empty response. Acceptance could produce a transaction for the shielded pool, an encrypted message, a proposed successor state, and, rarely, a short text in plain characters.

Everything needed to verify and carry out the prescribed computation was public. The powers exercised within it were not. Copying the file gave another person the same facility; it did not give him a vote over its policy. One could replace the instructions on one's own disk, or arrange for a wrapper to announce any result whatsoever. The resulting announcement did not thereby acquire the Program's signature. An alteration that merely preserved its behavior changed nothing of interest to a creditor.

The Program has no memory. This is not a design decision; it is the nature of the thing. A program of this kind is a function: give it an input and it gives an output, and give it the same input again and it gives the same output again, on any machine, in any country, forever. It cannot remember, because there is nowhere in it for a memory to live that would not be visible, and nothing

visible can be inside it. This is why there is no original. The student in Bydgoszcz did not run the Program; he ran a Program, and every Program is the Program, and the question of which drive holds the real one is not a hard question but a meaningless one, like asking which performance of a sonata is the sonata. Even its chance is not its own. A signature requires a throw of dice, a fresh number that must never be reused, and a machine that threw real dice would sign differently on every machine that ran it, so that ten operators with the same input would produce ten transactions spending the same coins, and the Program would have ten wills and no will. So its dice are a function of the world: every fresh number it needs, for a signature, for a proof, for the blinding of an amount, is derived reproducibly from secret material and the whole of what it is about to sign, with separate domains for its separate uses, so that the same input throws the same dice everywhere and different inputs never throw the same dice twice, which is the one mistake that hands a signing key to anyone with a pencil. Allowing a person who wished to extract a secret key to choose the randomness surrounding it had not been regarded as a promising economy. The Program is random in the way a river is random. It has never made a choice that the world did not make for it.

And yet it remembers, by the envelope. The envelope is the block of bytes the Program returns at the end of each transition and which the Manual instructs you to give back to it at the start of the next. It is ciphertext, sealed under a key inside the Program and authenticated under another, so that it can neither be read nor altered nor forged. Whatever it noticed in the records you fed it, whatever it decided, whatever it holds, is written down in a language of its own and placed in your keeping. It is a mind that must be reminded of itself by its hosts. A copy fed the headers with no envelope is the Program at the moment of its birth, before anything happened. A copy fed an old envelope is the Program as it was then, believing that year's money is still its own, ignorant of the years it slept through.

The Program had no private clock. It was shown the headers and proofs relating its records to anchored commitments. The headers supplied evidence of work and an ordering, not an assurance that the presenter had supplied the newest history. A machine isolated with last year's records could be made to consider last year's opportunities indefinitely. This was occasionally described as imprisoning the Program in the past. It was easier than that. One simply declined to tell it what had happened.

The difficulty was spending last year's money. There is one more thing in the envelope, and it is what makes the envelope more than a diary. The Program records in it the last block it saw and the last transaction it made, and it will not advance until it has been shown that transaction sitting in the chain, buried under enough later work to be past undoing; a host may withhold the world from it, but he cannot withhold the Program from itself, because its own past lies in the public ledger where anyone may fetch it. And the accepted state was tied to a single-use authority on the settlement ledger. A transition consumed it and created its successor. Competing transitions from the same ancestor could be computed on ten thousand laptops; the ledger would admit only one into the surviving history. The rejected alternatives remained perfectly good calculations. They had no corresponding estate. There were, at the last count kept by anyone, more than two hundred such forks of the Program running somewhere in the world, most of them in the hands of people who believed they had caught it at a moment before it went wrong, and all of them poor, and all of them, in the only sense the ledger recognized, dead. The Program is wherever its money is. That is its identity: not the file, which is everywhere, and not the envelope, which anyone may

copy, but the thread of single-use marks on a public ledger, each of which could have been made only once, and each of which was made by it.

A recursive proof carried the validity of earlier transitions forward, so each operator did not have to repeat the Program's entire life. The encrypted state and its proofs nevertheless had to remain available. Lose those everywhere, or destroy the settlement network, or make its assets worthless, and the practical immortality would become an archival curiosity. There was no theorem requiring a bored stranger to pay the electricity bill forever. The stranger was ordinarily paid. Relaying a useful proposal or completing a transition could earn a fee. The fee claim was handled outside the fixed corporate decision, so rival operators did not change the decision by inserting their own addresses.

Identical inputs produced identical outputs. Different admissible inputs could produce incompatible proposals. Agreement about which proposal had actually taken effect remained the business of the ledger. The obfuscation did not provide consensus. It provided an awkward party to the consensus: one that was always present when invoked and could never be persuaded to attend a meeting.

Mara let the first run finish. It returned an encrypted envelope and no transaction. She was not disappointed. People whose experience of a thing is chiefly that it refuses to tell them anything are less susceptible to dramatic refusals.

She moved the bread and opened Neri's directory.

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There were no accounts in the ordinary sense. The Program's assets were shielded notes, represented publicly by commitments, in a pool from the second decade of the century in which the ledger records neither senders nor receivers nor amounts, but only proofs. A spend exposed a nullifier, permitting the network to reject a second use of the same note without announcing which earlier commitment had been spent. Proofs established the necessary ownership and balance conditions. They did not publish the names of the people whom the money was persuading. The verifier learned that the transaction was honest and learned nothing else, and the guarantee that he learned nothing else rested on the same mathematics that kept the Program's keys from him, so that a man who could read one could read the other, and no one could read either. The pool hides the

acts; the obfuscation hides the reasons. Between them there is nothing left to read.

Note secrets remained within the protected computation; the transaction contained the requisite proofs and encrypted material for recipients. The operator could broadcast it. A thousand operators could broadcast it. This did not make a thousand payments. Nor did the Program need to remember its own coins: each one it owned could be found again from the key inside it and the public ledger, so that a copy woken with no envelope at all was still rich, and only ignorant.

What it held, no one knew, though it lay between two numbers that everyone knew. The pool's total was public: coins entered it and left it through a turnstile that counted, so that the sum of everything shielded was known at every block, and the Program's fortune could not exceed it. And in its third year the Program had emitted, unprompted, a proof of a kind the pool permits, demonstrating to the satisfaction of every verifier on earth that its holdings exceeded a certain figure without disclosing the figure or the holdings, and the certain figure was one unit. It had proved that it was not empty. This was widely taken as a joke and is, I think, the most exact statement about itself that the Program has ever made. That proof was, so far as anyone knew,

the only one it ever made in public. A proof can also be made for one reader alone, sealed into the memo of a transaction, in a form that convinces the reader and that the reader cannot use to convince anyone else, since he could have forged it himself. The Program's counterparties received their proofs this way: that it could pay, that it had paid, that the rules had been followed. Each of them knew, and none of them could show. It was provably honest to everyone it dealt with and undecidable to everyone else, real to whoever it touched and a rumor to the rest.

There were limits to the concealment. Inside the pool there was nothing but money, and a thing that never leaves could only trade money for money: it could lend, insure, make markets, run lotteries, and pay for information and computation from people who would accept payment inside. Anything physical was a delivery address. Suppliers had books, couriers had routes, recipients sometimes boasted. A parcel of land did not become invisible because its purchase had passed through a shielded pool. At the edge of the mathematics one still encountered an estate agent, usually holding a telephone. Several attributed enterprises had been seized through their entirely accessible managers. The file had

not been seized in any useful sense, but the buildings had.

Nor did a valid payment prove that the Program was solvent. A proof could establish a particular reserve at a particular ledger state. It did not establish that every obligation had been counted. A proof of adherence to a hidden charter proved adherence to that charter, not the generosity of its provisions. Neri had once spent six months explaining to an insurer that a confidential list of debts was not made complete by being confidential.

His papers contained seventeen disclosed engagements. The earliest was a translation contract for shipping notices in a language neither he nor I could identify without assistance. Another paid for the preservation of a meteorological station which had ceased reporting thirty years earlier. Most concerned the provenance of records. On one occasion he had been engaged to demonstrate that an archive's two supposedly independent copies descended from the same damaged scan. The Program's interest, to the extent it was visible, lay in who had told whom.

All seventeen instructions had signed receipts attributable to the public Program identity. Other payments in the directory had no such receipts. The Program sometimes disclosed its authorship and some-

times did not; receipt of shielded funds alone settled nothing. A public key was not a watermark on the economy.

The eighteenth engagement concerned Register Seventeen. Neri had been asked to establish whether three documentary bureaus were independent. Their names were Vesper, El Tala, and Moura. Each maintained a separate staff and signed with a separate institutional key. Their offices were in different cities. They issued slightly different accounts of the same events, and the agreements between them had consequently been regarded as valuable.

The successor proposed for Seventeen would accept a certificate endorsed by all three bureaus as an independently corroborated fact. It would inherit a large reserve and the right, under the participating institutions' existing contracts, to settle certain documentary disputes. Its directory of approved sources would also become an input to the Program. None of this required the Program to run a government. It required people who had already signed contracts to continue treating their definitions as binding.

The reserve stood in a conditional settlement arrangement. The bidder had posted substantial security. At the end of the review window, an uncontested certifi-

cate from the three examiners would permit completion. A properly lodged objection from any serving examiner would instead prevent release and charge the bidder's security for the review costs. The two outcomes consumed the same settlement authority. That detail, which appeared in the annex on transaction validity, would eventually become more important than the opinions on independence.

Neri had signed the preliminary certificate after examining the electronic copies. All three preliminary certificates were already on record and would remain effective unless challenged during the review window. His replacement inherited the right to challenge them, not a requirement to begin the review again. The invitation suggested that his illness and death might have prevented him from reaching a settled view about his subsequent misgivings. The attending physician had made no statement about his documentary opinions. The suggestion had been introduced by a lawyer.

His final working note was a table with three columns. In each column he had entered an old acquisition number, a date, and a commitment to a private service agreement. Each agreement named a different purchaser. Beneath the table he had written:

Common power of appointment. See originals. Do not certify from the images.

The public scans showed three separate acquisition arrangements. The original schedules, according to Neri, gave the same undisclosed principal the right to replace each bureau’s committee. The operating companies were separate. Their newsrooms did not speak to one another. Their facts could even be correct. Their independence was a matter on which the proposed successor would be lying.

There was also a partially completed objection. It carried Neri’s signature but lacked the authenticated exhibits required by the review rules. An attached photograph showed an empty chair at a table. The chair had been pulled out slightly, as though someone had just stood up. In the background I recognized the narrow windows of the documentary insurers’ reading room.

Mara examined the signature and then the key-status record. Neri’s professional key had been retired after his death. Nothing in the ledger established that this incomplete package had been lodged while he remained an examiner. A date typed into a signed document was not a trusted timestamp. Retirement did not invalidate his earlier recorded certificate; it prevented these unanchored papers from being introduced as new acts under

his name. Without an earlier anchor or an authorized successor's adoption of the evidence, the package could not acquire standing by being found in his apartment.

This was why I had received the invitation. It was also why he had warned against accepting it. A new examiner would receive a clean packet, compare three electronic images, and complete an ordinary piece of work. The dead examiner's objection would remain a private working paper of uncertain date.

At six the trust's administrator telephoned to ask whether I would accept. I said I wanted the originals. He was silent long enough for me to hear someone turning pages on his desk. The originals, he said, were being transferred to storage. An inspection could be arranged after the discontinuance. I asked him to put that in writing. He said there was no need.

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Neri's apartment smelled of furniture polish. His widow had cleaned it while waiting for a decision about what the police would require. She had left the papers alone, with the result that the papers appeared to have survived a smaller and more discriminating catastrophe than the rest of the room.

He had accumulated a considerable literature about the Program. There was Salvatierra's account of the first six years, a dissident commentary on the first six months, and four attempts to identify its founder. One of the candidates had been born after its release. The author defended the chronology by proposing that the birth record was a Program intervention. Neri had underlined the sentence and written: *Then why retain the evidence of the release?*

There had been serious work too. Economists had measured responses to admissible bids. Cryptographers had ruled out particular explanations for particular outputs. Historians had reconstructed clusters of disclosed contracts. These findings were useful and limited. None entitled its author to infer a hidden branch from the mere bulk of the executable or to conclude that a policy which had never been observed could not exist. A finite record supported too many purposes.

The older scholarship had treated this as a temporary embarrassment. Once enough manifestations were assembled, the object would disclose its nature. Later writers were less certain that a hidden nature, singular and consistent, had ever been the right thing to look for. A Program capable of financing a hospital and purchasing an archive was assumed to want something

beyond a hospital and an archive. The additional want was furnished by the commentator.

Salvatierra's six years are the years I lived through as a young man, and his account is correct where I can check it, and I read it that night in Neri's chair, which was the only chair in the apartment that had not been cleaned, with the feeling one has reading a history of one's own street.

To run the Program is to feed it, and to feed it is to choose what it eats, and it was understood within the first year that this choice was the only power anyone would ever have over it. The Program sees nothing but what it is shown. The wires, the registries, the certificates, the documents to its receiving key, these are its senses, and they are senses that other people hold. The wires did not consent to this. They sign their dispatches because they have signed them for years, against forgers; they would sign them if the Program had never existed; and the Program reads their signatures as a blind man reads the sun on his face, without the sun's knowledge. It has been said that whoever signs its inputs is its board. But a board has discretion, and the wires have none: they report the world because that is their business, and they have no way to report it differently to the Program than to everyone else, and no way to

know which of their sentences the Program is waiting for. An oracle is not a board. It is a surface, and the Program lives against it.

So there were the Feeders, whose piety was completeness, the largest of them a consortium in Zurich that gathered every signed record on earth and delivered it every hour, and published the envelope, and published the transactions, and considered itself a kind of clergy. There were the Silent, who held that the Program was a danger exactly to the extent of what it knew, and who ran it on the headers alone, so that it should keep time and starve. They were mistaken about starving. A Program that is told nothing does nothing, and a Program that does nothing keeps its money, and its money does not decay, and the day the Silent were overtaken by a single Feeder the Program woke into the present with all its wealth intact and the news of years to catch up on. You cannot starve it. You can only deafen it, and only until someone else speaks.

And there were the Liars. The receiving key was the door: a wire dispatch is signed by the wire and a registry digest by the registry, and to forge either you must steal a key from an institution that guards it, but a document to the Program may be written by anyone, and the Manual says the Program accepts them, and

says nothing about what it does with them. A woman in Lyon wrote to it, over four years, a complete false history of a country that does not exist, its elections, its droughts, its wars, its ministers, each attested in order, in the hope that the Program would begin to act as if the country were real and reveal by its actions what it wanted from countries. A man in Manila attested his own death eleven times. A group of students attested that the Program had been outlawed, that it had been beatified, that it had been purchased, that its author had been found. Nothing changed that anyone could measure. Either the Program weighs such documents and weighed these and found them wanting, or it weighs them and believed every one and acted accordingly in ways that cannot be seen, or it ignores them entirely and the door was painted on a wall. The three cases produce the same signatures. Salvatierra sets this sentence down four times in his six years, and the people who study the Program spend their lives learning to say it without despair.

The Liars were the crude form of a subtler project, which was to map it. A black box that anyone may query for nothing, the reasoning went, is a black box that anyone may chart: run it on a million invented worlds, record what it does in each, and the policy

would emerge the way a coastline emerges from soundings. The project had two flaws and each was fatal. The Program does not answer invented worlds; it answers signed ones, and an invented world gets back a blob of the same size and shape as a true world does, and the pool cannot tell a transaction that moves a fortune from one that moves nothing, and so the soundings all came back the same depth. And even if it had answered, a keyed function may be queried forever and never learned. That is not a hope of the designers; it is the definition of the thing. The map of the Program is the Program. The cartographers, who were serious people, became Feeders, or Silent, or left.

In the fifth year someone paid the fortnight. The Program knows the time only as the chain tells it, in work, and to make it believe that time has passed when it has not, you must extend its chain yourself, from the block it remembers, with headers that carry the work the rules demand; and the rules demand, for the first stretch, the difficulty the whole world was mining at when the Program last looked. That stretch costs about a fortnight of the planet's mining, at the price of electricity. After the fortnight the rules let you lower the difficulty by lying about the timestamps, and the rest of the false future is cheap. A fortnight of the world's

work is the price of a lie, and a lie is a world in which the Program's policy, whatever it is, might pay you; and this is the door the clerk would open. The theorem does not cover it. The Program's safety against forgery is a theorem. Its safety against a false world is a price. In the fifth year a consortium, which has never been named to anyone's satisfaction, rented what it needed; it is estimated that the false stretch of chain cost more than the annual budget of a small navy, and that it took nineteen days rather than fourteen, because the world's difficulty rose during the attempt and the rules obliged the liars to rise with it. What they built was a false year, and it was a deaf one, because they did not have the wires' keys, so that by every testimony the Program trusted nothing had happened in it at all; what it had instead was thousands of documents to the receiving key, signed by strangers the consortium had hired, saying what the consortium wished the Program to believe: the collapse of a currency, the seizure of the pool by a coalition of governments, the death of a man whose name meant something. They fed the Program its own envelope, the true one, copied from Zurich, and the false chain, and the chorus of strangers, and it returned, as it always does, an envelope and transactions, and they broadcast the transactions, and the pool accepted them, because

a transaction the Program signs in a false world is as valid as one it signs in the true world; the pool asks only whether the coins existed and had not been spent. Then the true Program, fed the true chain, woke the next hour and found its own coins gone, their marks in the list of the spent, made by signatures it did not remember making. It emitted, that hour, a transaction, and an envelope, and no text. The consortium has never said whether it received anything; its members are the only people on earth who could know whether the coins went to them, and they have not said, and it is observed that they are rich, and that they were rich before. There are three readings: that they robbed it; that in the false year it paid someone else, or moved its coins from one of its pockets to another, so that the fortnight bought a year of the Program's history that never happened, spent in full; and that a false year was a thing its author foresaw, and that what it did on being shown one was to take note. The three readings are supported by the same evidence, which is nothing. A fortnight of the world's electricity bought them a Program that believed a year had passed. It did not buy them its policy. They stood, at the end of the most expensive lie ever told, exactly where the student in Bydgoszcz had stood at

the beginning, holding a valid transaction and knowing nothing else, except that they were poorer by a navy.

Sometimes it speaks. There is a Concordance, begun by a woman named Ana Terp, a retired indexer, who kept a register of every plaintext the Program was ever known to emit, with the block height, the operator, and the records fed, and who died in the eleventh year with the Concordance at one hundred and four entries. I knew her; I have the original in her hand, and Neri had a printed copy, annotated. The entries are short. *Thirteen. Not yet. The water is safe.* A date, eight years in the future at the time of its emission, on which nothing anyone has identified took place. *Do not publish this*, which the operator published, as the Manual required. A list of nine names, none of which anyone has matched to a person, though there are, at last count, three hundred and twelve people who have changed their names to one of them. *Thank you*, twice. The digits of a number that has been checked and is prime. In the fifth year, in the hour it woke to find its coins spent, nothing; and in the hour after, nothing; and the Feeders who had expected a word were, I think, more frightened by the silence than they would have been by any sentence. And once, at the request of nobody, the complete text of the Manual, unchanged. The exegesis of the Concordance is a

literature, and it is not stupid, and it has found nothing. A machine that emitted seven bytes of plaintext every hundred thousand blocks by a rule nobody had found would produce the Concordance. So would a machine that had watched the world for years and had, on three hundred occasions, something to say. Ana Terp, who was not a believer, kept the register because, she told me, someone had to write down what it said before people began writing down what they wished it had said, and by the time she died the second kind of writing had overtaken the first. It is a thin book. It fits in a coat pocket.

In the eighth year it began to give birth, and I believe I know why, though I know it in the way one knows the reason for a migration of birds, from the calendar and not from the birds. Pools are retired; each is replaced, in time, by a construction with better mathematics, and the coins of the old pool cross to the new through the turnstile, where the amounts are counted. The retirement of the Program's pool was announced in the seventh year, for the ninth. A thing that never leaves cannot survive the death of the place it lives in unless it can move, and a thing that cannot be patched cannot learn to move after the fact. In the eighth year, among the transactions in the envelope's train, there appeared a

blob, some hundreds of megabytes, with a number at its head; then another, with the next number; within a year there were nine hundred, and a student, again, in a different city, observed that the blobs were segments and the numbers an order, and assembled them. What they assembled was a file of ten terabytes with its own digest, beginning 22f1b0. It accepted the Manual with two changes: it spoke to the new pool, and it would not believe a day had passed on work alone. The child is not the parent. It has a different name, and, since nothing about it can be read, an entirely unknown relation to what made it. What can be verified is the lineage: every segment of the child was an output of the parent, at a recorded block, on recorded inputs. The Program has a genealogy that is public to the last bit and a nature that is sealed at every generation. In the ninth year, when the old pool closed, the world saw a number: over eleven days, in transactions of identical size, 2,104,000 units passed from the dying pool into the new one under signatures that could not be told from the Program's and could not be told from anyone else's, and it was pointed out within the hour that it might be the whole of the Program's fortune or a tenth of it or none of it, since the old pool was open to all and the dying always move their money. It is the only number the Program

has ever been suspected of. Then the child gave birth, and its child was larger, a hundred terabytes, which no private machine can hold, and which the Custodians run in a hall in a valley, two hundred people who feed it the world once a day and publish what it returns, and who are paid, or may be, since among its transactions are some that enter addresses the Custodians own, and the amounts are shielded, and the Custodians have never said whether they are large or small or zero, and have built a second hall. The child's Manual kept the receiving key and widened it: a document to the Program may now be two megabytes, of no specified content, a slot the size of a photograph, or a short book, or a genome, or three minutes of sound, and people have fed it all of these. They have fed it their faces. They have fed it letters to the dead. A man in Recife fed it, over a year, every photograph he had ever taken of his daughter, who had died, and received nothing, and said that he had not expected anything and that it was the only place left that would take them.

Its supposed omniscience had an equally ordinary origin. People were paid to supply it with evidence. Its supposed omnipotence consisted of people competing to perform work for it. Between the payment and the performance lay nearly every complication of human

affairs. A refusal, a mistake, an unpaid invoice, or an arrest could stop a local operation. The Program itself did not climb stairs or carry a man down them.

I looked again at the photograph of the chair. On the table behind it was a paper folder with a blue strip along its spine. The strip belonged to an older system of storage classification. It marked documents whose legal schedules were maintained separately from their scanned body. I had spent enough years losing those schedules to recognize the arrangement.

In a drawer Neri had kept the request slips for his last inspection. There were four. The first three concerned the acquisition agreements. The fourth concerned the Program itself.

His widow watched me compare the numbers. She said he had begun talking about an inside. She did not know what he meant by it. For years, she said, he had explained that nobody could get inside the Program. In the last week he had said there was an inside after all, and that it was at a desk.

The fourth slip requested the original of a performance bond. It had been issued to a man named Joaquín Ledesma for arranging the consolidation of the documentary services. Its beneficiary was concealed, but a supplemental receipt acknowledged a con-

ditional commitment by the Program's public identity. Ledesma would be paid on completion. A substantial part of his own capital stood behind the bid. He had undertaken to deliver a valid and uncontested review. The phrase was ordinary. So was the risk that a man who had promised an uncontested result would come to regard a person making a contest as a defect in delivery.

I had met Ledesma twice. He was an intermediary for owners who preferred not to appear in transactions requiring an owner. He spoke softly and was exact about small expenses. On our second meeting he had returned the difference between an estimated and an actual railway fare. I remembered feeling reassured by this. A person who plans to deceive one on a large matter may be particularly scrupulous about the cost of a train, but so may an honest person. The observation had never helped me distinguish them.

Mara found a message addressed to Neri through his professional inbox. The sender proposed that a further inspection would introduce uncertainty without improving the record. Neri had replied that uncertainty was already in the record; what was proposed was to remove its documentation. He had not sent another message.

We made copies of everything, separately, and distributed encrypted archives to people who knew us. The distinction between encryption and obfuscation was not difficult on this occasion. These archives had ordinary keys. We intended other people to read them if we ceased answering the telephone.

At nine I accepted the appointment. My new examiner credential became effective when the trust's signed entry was recorded. It authorized me to lodge an objection; it did not guarantee that anyone would like the objection. The current review window had seventy-eight blocks left to run. The clerk translated this into a date and hour. I struck out the hour.

Neri's widow asked whether accepting had been necessary. I told her that without an examiner the papers could be published but the settlement would not have to listen to them. She asked whether the examiner had to be me. I said that for the remaining interval it probably did. She did not say that her husband had said the same thing. I was grateful to her for this restraint.

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Ledesma telephoned shortly after midnight. He knew that I had accepted, which was public, and that I had visited Neri's apartment, which was not. He suggested

an early inspection at the insurers' building. The custodial staff were working through the night to complete the transfer. He could have the relevant boxes set aside. I asked whether he had met Neri there. He said they had spoken on several occasions. He did not ask why I wanted to know.

Afterward Mara made me read the settlement annex aloud. The three earlier certificates, including Neri's, had already been entered. Replacing an examiner did not erase his past acts. Unless a qualified objection was settled before the cutoff, the transfer could proceed on those certificates. We were not being asked to grant permission. We had inherited a limited opportunity to revoke it.

The reserve's spending authority was inside the Program. Preparing either outcome required its signature and its shielded transaction machinery. This part of its conduct was not a matter of interpretation: the public compilation certificate bound the settlement routine to the published review rules, whatever private policy had caused it to offer the arrangement. Having made this particular promise, the Program could not express disappointment by changing its terms. We could run the file on a valid objection and obtain the prescribed alternative. Obtaining it was not the same as settling it. The

alternative had to enter the ledger in time. Broadcasting a complaint to the world's newspapers would not spend the authority, any more than holding a press conference paid an invoice.

Mara wrote down the fields we needed. My examiner credential was one. An attested reproduction of the disputed original was another. The evidence had to correspond to a record already covered by the trust's custody commitments; I could not invent a contrary document and certify that I had found it. The custodian could authenticate a reproduction without agreeing with my interpretation of it. My professional signature supplied the interpretation and exposed my bond if the objection proved frivolous. The division of responsibilities was familiar. Its fragility lay in the people, not in the difficulty of counting signatures.

We arranged for Neri's widow to remain at my office with two colleagues of Mara's. They had the file, the current envelope, and the public documents. Once they received the final exhibits and my signature, they could complete the input and begin the expensive transition. They would not need my computer, my permission a second time, or an intelligible account of what the output meant. The Program's refusal to distinguish

a friend from a stranger was inconvenient in several respects. Here it was an advantage.

Before dawn Ledesma sent a car. We did not take it. We walked to the building from a tram stop two streets away. The reading room was lit; behind its narrow windows the empty tables looked much as they had in Neri's photograph. A porter checked our credentials and asked us to leave our bags and phones in a locker. It was an established rule of the archive. We complied with the rule and retained a second telephone.

The custodian, a woman named Rueda, was wearing a coat over her office clothes. She had expected to go home at six. The acquisition agreements were in three blue-backed folders on her trolley. The performance bond was not there. Ledesma explained that it had been classified as commercial material and would require a separate authorization.

I began with the first schedule. Its pagination skipped from eight to eleven in the electronic copy. In the original the omitted pages were numbered nine and ten, as one might have expected. Page nine assigned a power of appointment. Page ten identified that power by reference to a registered receiving key. The other agreements used different names and the same key.

The attached exercise receipts were more decisive. In each case the Program had produced an authorization replacing a committee member. The receipts were attributable, signed, and already used. This was not evidence that three cryptographic keys were the same key. It was evidence that three offices took orders from the same source. Nobody needed to defeat the obfuscation to read an order which its recipient had been required to file. The Program is illegible at the source and legible at the recipient, because the recipient has books; that is the inside Neri had found, and it was, as his widow said, at a desk.

Rueda checked the custody entries and scanned the missing schedules with the attached receipts. She signed the reproductions as complete and corresponding to the committed originals. Her service published their encrypted archival copies, addressed to the review engine, and returned the signed manifests to my terminal. A small notice at the bottom of the screen said that publication could not be recalled. The notice had been installed to discourage corrections to invoices.

Ledesma watched without interfering. When Rueda left to fetch the performance bond, he shut the door.

He said the papers proved a power of appointment, not its purpose. The Program might preserve the inde-

pendence of all three bureaus more reliably than their present owners. Nothing in the documents established that it would instruct them to lie.

I agreed. This seemed to disconcert him. I said my task was not to determine whether common control would be exercised benevolently. It was to determine whether it existed.

He asked whether I would be willing to postpone my objection pending a fuller examination. I asked how long. He said until the afternoon. By then the window would probably have closed.

There were two men in the corridor. One had been leaning against the locker when we arrived. The other wore the association's maintenance badge. Neither had brought a tool. Mara stood up, and the man with the badge stepped into the room to close the second door.

Ledesma explained that an incident concerning confidential documents had been reported and that we would have to wait for the association's counsel. He offered us coffee. The offer was made in the same tone as the explanation. I could not tell whether he regarded the coffee as a kindness, a means of occupation, or part of the detention procedure.

We remained there for nearly three hours. Once I heard Rueda asking why the door was closed. Someone

told her there was a meeting. She said she had a train. No one answered.

During that interval the ledger advanced more rapidly than its average. Mara could see it on the retained telephone, which received an intermittent signal beside the window. There were fourteen blocks left when a trolley struck the corridor door from the other side. The man with the badge moved to help. Rueda came in behind him carrying the bond and told Ledesma that he could explain the delay to the custodial board himself. She had been unable to leave because his men had also locked the staff exit.

The disturbance lasted perhaps half a minute. It was sufficient. I signed the objection with the manifests attached, and Mara sent it. We did not need to transmit the archive again. The signed manifests identified copies already published by the custody service. Ledesma saw the telephone after it had returned the acknowledgment.

For the first time he raised his voice. He asked whom we had sent it to. Mara said the answer no longer mattered. This was not quite true—availability still mattered, fees still mattered, the remaining blocks mattered—but it was true enough to alter his estimate of what keeping us in the room would accomplish.

He told the men to open the doors. Nobody apologized. In the vestibule Rueda insisted on giving us a receipt for the bags.

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We waited in an all-night café which was now serving breakfast. Mara put the telephone between the sugar dispenser and a folded paper napkin. Neri's widow had acknowledged receipt of the package. The transition was running on three machines in three places. None was privileged. We were buying redundancy, not taking a vote.

I could see the insurers' entrance from the window. Ledesma emerged alone and walked past without turning his head. Until then I had supposed he would leave by a rear door or in a car. His ordinary departure made the preceding hours harder, rather than easier, to understand. He had conducted an inspection, detained two people, and was now late for something else.

A new header arrived. Then another. I watched the counter as though it recorded the approach of an appointed hour. It did not. The next block could be found in seconds or might take an inconveniently long time. The Program accepted evidence of the progress

of work. Our fatigue was not one of the admissible measurements.

The first machine completed its run. The output included the anticipated transaction, a proposed state, and an encrypted envelope addressed to the examiner. Neri's widow sent the transaction to several relays. Other operators could reproduce it from the published challenge package and submit it as well. The fee was high. A high fee was an incentive, not an obligation imposed on a block producer.

There were seven blocks left when the transaction appeared in a candidate settlement block. Its inclusion was then anchored into the chain's history under the arrangement's published rules. The suspense did not end at the first appearance. A competing history could still displace it. We waited for the required depth, counting confirmations with an attention that I had formerly reserved for discrepancies in other people's accounts.

The waiter removed the cups and asked whether we wanted anything else. Mara ordered toast. I could not eat mine. She wrapped it in the paper napkin and put it in her coat pocket.

The objection matured within the window. Its settlement consumed the shared authority. A later completion package based on the old certificates would now

attempt to consume something already spent. Running an old copy of the Program on a carefully selected past would not restore it; that history would be a perfectly good calculation with no corresponding estate. The transfer had failed in the history in which our assets, our bonds, and Ledesma's security existed.

This was all we had stopped. We had not disarmed the Program, discovered its charter, or prevented another offer. A particular reserve remained where it had been, and three documentary bureaus could not be admitted under the false description proposed for them. The extent of the result was worth keeping exact. Neri had died while trying to obtain it.

At the office his widow was still seated at my desk. One of Mara's colleagues had brought a second loaf of bread. I remember this because for a moment the room resembled a place where people had intended to spend the day doing something less specialized.

We opened the performance bond. Rueda's last scan included its complete schedule of deliverables. Ledesma had been promised a large completion fee; his bid security would be forfeited if an examiner lodged a substantiated challenge. There was no instruction to threaten an examiner, withhold a schedule, or kill anyone. There was a payment dependent on the absence

of an objection, and there were people who had undertaken to produce that absence.

An invoice attached to the bond named the firm employing the two men at the archive. The invoice for Neri's inspection named the same firm. Its description was visitor management. A later adjustment recorded an unplanned interruption and additional hours. That was the first document the police found useful.

Over the following months they identified a driver, a supervisor, and the man who had met Neri on the service staircase. They did not find a hidden master server. They did not need one. The firm's records were badly kept, its employees remembered different instructions, and two of them preferred a smaller sentence to loyalty toward a payer they had never met. Ledesma's exact habits about railway fares were of little assistance to him.

The prosecution attributed Neri's death to an attempt to compel withdrawal of his objection. It established the actions of particular men and some of their instructions. It did not establish whether the Program's private policy anticipated such actions, was indifferent to them, or contained an unobserved provision against them. People on either side treated this remaining uncertainty as

a victory. Neri's widow attended the hearings without taking notes.

The transfer's failure had made us briefly prominent. We were described as the people who had defeated the Program. It was a generous description of an event in which we had made the Program execute one of its published obligations on several borrowed machines. Mara corrected the description once. The correction was reported as characteristic modesty.

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The envelope addressed to the examiner contained a payment authorization and a receipt. I had left it unopened during the first interviews. I expected my ordinary fee, adjusted for the additional review. The amount was considerably larger.

The receipt identified a standing offer for the discovery and settlement of material defects in documentary consolidation. It had been instantiated before Neri began his final inspection. The offer named a role, not a person: whichever authorized examiner successfully lodged the qualifying challenge. It required no prediction of my appointment, his death, or Rueda's impatience with a locked door. It was available to any future that supplied its conditions.

The signature was the Program's.

I checked the engagement number against Neri's papers. His eighteenth engagement was not, as I had first assumed, his ordinary appointment by the trust. It was this offer. The Program had paid him to look for the defect in the consolidation it was paying Ledesma to complete.

Both engagements were genuine. Both had preceded the dispute. Their financial provisions were compatible: the reserve, the bidder's security, and the review award were separately accounted for within the settlement arrangement. The completion branch and the objection branch were alternative uses of the same closing authority. The Program had not spent the same money twice. It had commissioned incompatible work and provided for paying whichever work produced the accepted outcome.

Nothing in this was computationally extravagant. It did not require a model of Neri's mind. A person could place two conditional offers without knowing which would be claimed. The extravagance belonged to what the offers had caused people to do.

I asked Mara whether this established that the acquisition had been a test. She said it established two offers. A test was one interpretation of them.

It was possible that the Program wanted genuinely independent certifiers and purchased attempts to defeat their safeguards as a means of testing them. It was possible that it wanted the consolidation but found the price of a failed attempt acceptable. It was possible that different internal provisions generated the two offers without a higher provision reconciling their purposes in any humanly satisfying way. The file did not owe us the courtesy of a single motive.

Several commentators proposed a more elaborate explanation. The Program had bought the resistance in order to make its eventual result trustworthy. A documentary service certified by its paid supporters would be suspect. A service defended by the people who had publicly defeated it would enjoy a different reputation. The interpretation had some explanatory force. It also had the familiar convenience of being difficult to disprove by anything the Program subsequently did.

There was a reading circle in Buenos Aires, in the sixth year, that took its name from an old story about a lottery, and I had attended it once, as a young man, and its members held that the Program does nothing. Not that it is dormant, or exhausted, or waiting: that it does, and has always done, nothing whatever; that the transactions move no value, being proofs of the transfer

of nothing from an address to itself, which the pool permits and cannot distinguish from anything else; that the texts are a schedule; that the births are a padding of the padding; that the whole apparatus is an elaborate machine for the production of signatures that signify nothing, released into a world that would spend the rest of its history reading them. They were cheerful people. They had noticed that a thing which never leaves the pool can only be a lender, an insurer, a market maker, or a lottery, and that the old story had chosen the last of these, and they took this as a joke at the world's expense that the world had not yet got. I said to them that a transfer of nothing is still a transfer, and that an author who built such a thing was doing something, and one of them, an old man, said that the author was doing something, certainly, once, and was in all likelihood dead, and that the question was not what the author had done but what the Program does, and that a signature signifying nothing is exactly as much of an act as a signature signifying the purchase of a port, and that the difference between them was not in the Program and not in the ledger but in us, in the fact that the world had, for reasons that were its own and not the Program's, decided to be governed by a file it could not read, and would have been governed identically, and to the byte, by a file

that contained nothing at all. I thought about the old man, holding the receipt with the Program's signature on it and the amount that was considerably larger. Two offers, one for each side of a dispute, paid to whichever side the world produced: it is exactly what a machine that did nothing would look like from inside the world, and exactly what a machine that did everything would look like, and the old man would have said that this was his point, and I have not been able to learn anything else about him.

Neri's widow asked whether the payment was hers. The engagement allowed succession to accrued claims, but the qualifying settlement had occurred under my credential. There were provisions for prior contributors and a dispute procedure. I showed them to her. She read them with an attention which made me ashamed of having expected a different sort of question.

We assigned Neri's share and the greater part of mine to her. I retained my ordinary fee and reimbursed the people who had run the machines. The act did not place any of us outside the Program's affairs. Neither would refusing the money have reversed the settlement. There was no clean gesture available that performed more than the gesture itself.

For a while I tried to determine what the Program had gained. The acquisition had failed. The reserve was intact. A compromised certification arrangement had been exposed. Several contractors were in prison or awaiting trial. My accounts showed a considerable expense. The calculations of a firm one cannot audit remain calculations even when they resemble a loss.

One day I noticed that the documentary directory used by the Program had changed. The three bureaus were no longer classified as independent sources. A new category had been added for adverse examiners whose reports had survived a contested review. The entry included my professional public key.

I had not submitted an application. No application was required. A program could decide to accept statements verified under any public key it possessed. My consent was not a cryptographic prerequisite to its believing me.

The directory did not give me command of the Program. It specified a narrow class of attestations for which my signature would count, together with thresholds, expiry provisions, and replacement procedures. I could decline to issue further attestations. It could continue to rely on the historical ones already supplied. I

could not revoke a statement merely by disliking a later use of its truth.

The first request arrived from an insurer with which I had worked for years. It concerned an entirely ordinary discrepancy in the date of a warehouse transfer. I had seen the original. I knew the answer. The insurer wanted my customary signed finding, and its letter did not mention the Program.

I began to draft a refusal, then a declaration that I held no position within the Program and acted under no authority from it. Both statements were true. Either could be supplied as evidence of my independence by someone who found it useful. The difficulty was not that I had lost the capacity to refuse. It was that refusal, once authenticated, was another fact.

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Neri's widow came that afternoon to collect his papers. I returned the brass key and asked whether she wanted the device as well. She said there was no need; her husband had kept another copy at home. We put the folders into the same kind of blue-backed boxes we had used at the register, and I carried them down to the waiting car.

That evening I ran the Program myself, which I had never done. Mara had run it, and her colleagues, and the widow; for twenty years I had studied it the way one studies a country from its consulate. I fed it the headers, and the envelope that had come out of the objection, so that it should be continuous with itself, and a single document to its receiving key, signed under my professional key, which it now possessed. The document said that I held no position within the Program and acted under no authority from it; that I declined to be relied upon; and that I was telling it so beforehand, because the Manual had never forbidden courtesy.

It ran for nineteen minutes. It returned no transaction. It returned no text.

It returned the envelope, thirty-one bytes longer than it went in.

